

and second film sections and said high resistance state results from a cross section of said copper fuse being oxidized to copper oxide and said cross section is located in said opening.

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**REMARKS**

Applicant respectfully submits that entry of this §1.116 Amendment is proper. Since the amendments above narrow the issues for appeal and merely clarify the subject matter of the claims. Applicant further respectfully submits that such amendments do not raise a new issue requiring a further search and/or consideration by the Examiner. As such, entry of this §1.116 Amendment is earnestly solicited.

Claims 1-5, 7, 15, 16, and 20-24 are pending in this application. This Amendment amends claims 1 and 20 and cancels claims 17-19 and 26-28 without prejudice or disclaimer. Please note that claim 25 was canceled in the Amendment filed on September 5, 2002. No new matter is added to amended claims 1 and 20. Claims 1 and 20 are amended to merely clarify the subject matter of the claims and in no way narrow the scope of the claims in order to overcome the prior art or for any other statutory purpose of patentability. Notwithstanding any claim amendments of the present Amendment or those amendments that may be made later during prosecution, Applicant's intent is to encompass equivalents of all claim elements. Reconsideration in view of the foregoing amendments and the following remarks is respectfully requested.

Attached hereto is a marked-up version of the changes made to the claims by the current amendment. The attached pages are captioned "**Version with markings to show changes made.**"

Claims 1-5, 17-23, and 26-28 stand rejected under 35 U.S.C. §102(e) as anticipated by U.S. Patent No. 6,111,301 to Stamper. Claims 7, 15 and 24 stand rejected under 35 U.S.C. §103(a) as unpatentable over Stamper as applied to claims 1 and 20 above, and further in view of U.S. Patent No. 6,162,686 to Huang et al. (hereinafter, Huang). Claim 16 stands rejected under 35 U.S.C. §103(a) as unpatentable over Stamper and Huang as applied to claims 1 and 7 above, and further in view of U.S. Patent No. 6,100,118 to Shih et al. (hereinafter, Shih).

These rejections are respectfully traversed in view of the following discussion.

## **I. THE CLAIMED INVENTION**

The claimed invention, as claimed in claim 1, is directed to *inter alia* a semiconductor memory device, including a copper fuse section that is oxidized by a laser beam in an oxidizing environment. The semiconductor memory device includes a dielectric film, a wiring line structure and an opening. The dielectric film includes a first film section formed on a substrate, a second film section formed on the first film section, and a third film section formed over the second film section. The wiring line structure includes a first and a second wiring line, where each of the first and second wiring lines are formed directly upon the second film section of the dielectric film without an intervening film therebetween and where each extends in an opposite direction, and the copper fuse section that is formed on the first film section of the dielectric film, where an end of the copper fuse section is directly connected to the first wiring line by a first section of the first wiring line, which penetrates a portion of the second film section, and another end of the copper fuse section is directly connected to the second wiring line by a second section of the second wiring line, which penetrates a portion of the second film section. The opening is formed in the third and second film sections of the dielectric film and between the first and second wiring lines, where sidewalls of the opening are formed only from the third and second film sections and provide access to the laser beam to oxidize the copper fuse section in the oxidizing environment.

The claimed invention, as defined in claim 20, is similar to that of claim 1 above, wherein sidewalls of said opening are formed only from the third and second film sections and the high resistance state results from a cross section of the copper fuse being oxidized to copper oxide and the cross section is located in the opening.

Thus, the sidewalls of the opening of the claimed invention are formed only of the dielectric films comprising the third and second film sections.

## II. THE PRIOR ART REJECTIONS

### A. The Stamper Reference

Fig. 4 of Stamper discloses a copper fuse 2 that is connected to metal conductors 6, on both left and right sides, through a relatively low resistivity metal 9, such as, copper (col. 3, lines 11 and 12). A via 4 is formed that includes sidewalls 3 of the corrosion barrier, presumably tungsten or the like, and back and presumably front walls of silicon dioxide 8.

Claims 1 and 20 recites at least the features of "a dielectric film including ... a second film section formed on said first film section, and a third film section formed over said second film section ... wherein sidewalls of said opening are only formed only from said third and second film sections".

Stamper discloses a via 4, which corresponds to the present invention's opening, formed of sidewalls 3 of the corrosion barrier 3, and back and front walls of silicon dioxide. In contrast, the present invention claims an opening wherein the "sidewalls of said opening are only formed from said third and second film sections", which are dielectrics. The present invention, therefore, does not require the additional deposition of a corrosion barrier around the dielectric films of the opening

For at least the reasons outlined above, Applicant respectfully submits that Stamper does not teach or suggest every feature of claims 1 and 20. Accordingly, Stamper does not anticipate or render obvious the subject matter of claims 1 and 20 and claims 2-5 and 20-23, which depend from claims 1 and 20. By this Amendment, claims 17-19 are canceled without prejudice or disclaimer; hence, the rejection of claims 17-19 is moot. Withdrawal of the rejection of claims 1-5 and 20-23 under 35 U.S.C. §102(e) as anticipated by Stamper is respectfully solicited.

### B. The Huang Reference

Fig. 5 of Huang discloses *inter alia* a plug fuse 58B which is connected through first fuse plugs 38B and contact plugs 26, both being located beneath the plug fuse 58B, to conductive strips 20A, 20B, also located beneath the plug fuse 58B. Conductive strips 20A, 20B penetrate the first insulating layer 24, the second insulating layer 30 and the intermetal dielectric layer 42

to contact the metal layer 44, M2.

Applicant respectfully submits that Huang can not be combined with Stamper as proposed by the Examiner. Moreover, Huang does not cure the deficiencies of Stamper. Nowhere does Huang teach or suggest "sidewalls of said opening are only formed only from said third and second film sections," which are dielectrics as recited in claims 1 and 20.

For at least the reasons outlined above, Applicant respectfully submits that Stamper and Huang either in individually or in combination fail to teach or suggest every feature of claims 1 and 20. Accordingly, Stamper and Huang either in individually or in combination fail to render obvious the subject matter of claims 1 and 20 and claims 7, 15 and 24, which depend from claims 1 and 20 under 35 U.S.C. §103(a). Withdrawal of the rejection of claims 7, 15 and 24 under 35 U.S.C. §103(a) over Stamper as applied to claims 1 and 20, above, and further in view of Huang is respectfully solicited.

### **C. The Shih Reference**

Fig. 3 of Shih discloses a wiring line 42, which is disposed above and parallel to wiring line structures 31A and 31B.

Applicant respectfully submits that Shih can not be combined with Stamper and Huang as proposed by the Examiner. Moreover, Shih does not cure the deficiencies of Stamper and Huang. Nowhere does Shih teach or suggest "sidewalls of said opening are only formed only from said third and second film sections," which are dielectrics as recited in claim 1.

For at least the reasons outlined above, Applicant respectfully submits that Stamper, Huang, and Shih either in individually or in combination fail to teach or suggest every feature of claims 1 and 20. Accordingly, Stamper, Huang, and Shih either in individually or in combination fail to render obvious the subject matter of claims 1 and claim 7, which depends from claim 1 under 35 U.S.C. §103(a). Withdrawal of the rejection of claim 7 under 35 U.S.C. §103(a) over Stamper and Huang as applied to claims 1 and 7 above, and further in view of Shih is respectfully solicited.

For the reasons stated above, the claimed invention is fully patentable over the cited

references.

### III. THE 35 U.S.C. §112, FIRST AND SECOND PARAGRAPH, REJECTIONS

Claim 25 is rejected under 35 U.S.C. §112, second paragraph. Applicant respectfully submits that claim 25 was canceled in the Amendment filed on September 5, 2002; hence, the rejection of claim 25 under 35 U.S.C. §112, second paragraph, is moot.

### IV. CONCLUSION

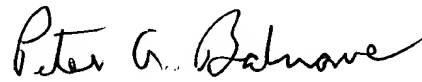
In view of the foregoing, Applicant submits that claims 1-5, 7, 15, 16, and 20-24, all the claims presently being considered in the application, are patentably distinct over the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue at the earliest possible time.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary in a telephonic or personal interview.

The Commissioner is hereby authorized to charge any deficiency in fees or to credit any overpayment in fees to Attorney's Deposit Account No. 50-0481.

Respectfully Submitted,

Date: 12/30/02



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**VERSION WITH MARKINGS TO SHOW CHANGES MADE**

**IN THE CLAIMS:**

**Please amend claims 1 and 20 as follows:**

1. (Four Times Amended) A semiconductor memory device, including a copper fuse section that is oxidized by a laser beam in an oxidizing environment, comprising:

a dielectric film including a first film section formed on a substrate, a second film section formed on said first film section, and a third film section formed over said second film section;

a wiring line structure, including:

a first and a second wiring line, each of said first and second wiring lines formed directly upon said second film section of said dielectric film without an intervening film therebetween and extending in an opposite direction, and

said copper fuse section formed on said first film section of said dielectric film, an end of said copper fuse section being directly connected to said first wiring line by a first section of said first wiring line, which penetrates a portion of said second film section, and another end of said copper fuse section being directly connected to said second wiring line by a second section of said second wiring line, which penetrates a portion of said second film section; and

an opening formed in said third and second film sections of said dielectric film and between said first and second wiring lines, wherein sidewalls of said opening [provides] are formed only from said third and second film sections and provide access to said laser beam to oxidize said copper fuse section in said oxidizing environment.

20. (Twice Amended) A semiconductor device that includes a copper fuse, comprising:

a dielectric film including a first film section formed over a substrate, a second film section formed on said first film section, and a third film section formed on said second film section;

a first wiring line and a second wiring line, each of said first wiring line and said

second wiring line being formed on said second film section of said dielectric film;

said copper fuse formed on said first film section of said dielectric film, an end of said copper fuse being directly connected to said first wiring line by a first section of said first wiring line, which penetrates a portion of said second film section, and another end of said copper fuse being directly connected to said second wiring line by a second section of said second wiring line, which penetrates a portion of said second film section, and said copper fuse being programmed to a high resistance state by oxidation; and

an opening formed in said third and second film sections of said dielectric film and between said first wiring line and said second wiring line,

wherein sidewalls of said opening are formed only from said third and second film sections and said high resistance state results from a cross section of said copper fuse being oxidized to copper oxide and said cross section is located in said opening.